

The Claims Defining the Invention are as Follows:

1. A switched DC rotating electrical machine comprising a stator, a rotor and switching means, one of said stator and rotor comprising an excitation winding having a first and a second input, the excitation winding being adapted when energized to cause magnetization of an even plurality of poles associated with said excitation winding, the switching means being adapted to be associated with a DC voltage source to switch the output thereof to the first and a second input of the excitation winding, the DC voltage source providing a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, wherein in use the intermediate voltage output is continuously connected to the first input of said excitation winding and the second input is switched in a cyclic operation by said switching means between connection with the high voltage output and the low voltage output.
2. An electrical machine as claimed at claim 1 wherein the cycle of the cyclic operation also includes segments of time when the second input is disconnected from either of said low voltage or high voltage outputs.
3. An electrical machine as claimed at claim 1 or claim 2 wherein the excitation winding is configured to energize adjacent poles associated with said excitation winding with opposite magnetic polarity.
4. An electrical machine as claimed at any one of the previous claims wherein the voltage differential between the low voltage output and the intermediate voltage output is substantially the same as the voltage differential between the intermediate voltage output and the high voltage output.
5. An electrical machine as claimed at any one of the previous claims wherein the other of said stator and rotor not comprising said excitation winding comprises an even plurality of poles.

6. An electrical machine as claimed at any one of the previous claims wherein the switching of the switching means is synchronised with the rotation of the rotor.
7. An electrical machine as claimed at claim 6 wherein switching means comprises sensing means adapted to cause switching of the switching means
5 according to the rotational position of the rotor.
8. An electrical machine as claimed at claim 7 wherein the sensing means comprises a photoelectric sensor.
9. An electrical machine as claimed at claim 7 or claim 8 wherein a timing wheel is associated with the sensing means to provide a reference for the
10 rotational position of the rotor.
10. An electrical machine as claimed at any one of claims 6 to 9 wherein the second input is switched to the high voltage output or to the low voltage output when a pole of the rotor is positioned in opposed relationship to a pole of the stator.
- 15 11. An electrical machine as claimed at any one of claims 6 to 10 wherein the second input is switched to a disconnected state substantially at a predetermined moment selected to minimize transient currents.
12. An electrical machine as claimed at claim 11 wherein the second input is disconnected from the DC voltage source for a substantial proportion of the cyclic
20 period.
13. A switched DC rotating electrical machine comprising a stator, a rotor and switching means, the stator being configured with a stator set of poles comprising a plurality of magnetic poles and the rotor being configured with a rotor set of poles comprising a plurality of magnetic poles, a one set of said stator set and
25 rotor set being configured to provide a magnetic field and the other set of said stator set and rotor set being configured with an excitation coil associated with each pole of said other set, said coils being adapted to be excited by a DC

voltage source by means of a first input and a second input to thereby induce a magnetic field in association with each pole, said coils being configured to cause said magnetic fields of adjacent poles to be magnetized to opposite polarity, connection to said DC voltage source being controlled by said switching means
5 whereby in use, by the rotation of the rotor with respect to the stator, the magnetic field of the one set is adapted to move relative to the poles of the other set, the DC voltage source having a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, the
10 intermediate voltage output being adapted in use to be continuously connected to a first input of the said coils and the second input being adapted to be cyclically switched by said switching means between said low voltage output and said high voltage output.

14. A switched DC rotating electrical machine comprising a stator, a rotor and
15 switching means, one of said stator and rotor comprising an excitation winding having a first and a second input, the excitation winding being adapted when energized to cause magnetization of a first even plurality of poles associated with said excitation winding and being configured to energize adjacent said associated poles with opposite magnetic polarity, the other of said stator and rotor
20 comprising a second even plurality of poles, the switching means being adapted to be associated with a DC voltage source to switch the output thereof to a first and a second input of the excitation winding in cyclic operation, the switching means being configured to cause switching of the excitation winding to an energized state when a pole of the rotor is positioned in opposed relationship to a
25 pole of the stator.

15. An electrical machine as claimed at claim 14 wherein the cycle of the cyclic operation also includes segments of time when the second input is switched to a state disconnected from the DC voltage source.

16. An electrical machine as claimed at claim 15 wherein the second input is switched to said disconnected state substantially at a predetermined moment selected to minimize transient currents.

17. An electrical machine as claimed at any one of claims 14 to 16 wherein the
5 switching of the switching means is synchronised with the rotation of the rotor.

18. An electrical machine as claimed at any claim 17 wherein switching means comprises sensing means adapted to cause switching of the switching means according to the rotational position of the rotor.

19. An electrical machine as claimed at claim 18 wherein the sensing means
10 comprises a photoelectric sensor.

20. An electrical machine as claimed at claim 18 or claim 19 wherein a timing wheel is associated with the sensing means to provide a reference for the rotational position of the rotor.

21. An electrical machine as claimed at any one of claims 14 to 20 wherein the
15 DC voltage source provides a low voltage output, a high voltage output and an intermediate voltage output having an electrical potential intermediate the electrical potentials of the high voltage output and the low voltage output, wherein in use the intermediate voltage output is continuously connected to the first input of said excitation winding and the second input is switched in said cyclic
20 operation by said switching means between connection with the high voltage output and the low voltage output

22. An electrical machine as claimed at any one of the previous claims wherein the electrical machine is an electric motor.

23. An electrical machine as claimed at any one of claims 1 to 21 wherein the
25 electrical machine is an electric generator.

24. An electrical machine as claimed at any one of the previous claims wherein the excitation winding is associated with the stator.
25. An electrical machine as claimed at claim 24 wherein the rotor comprises a winding energized from a DC power supply via slip rings.
- 5 26. An electrical machine as claimed at claim 24 wherein the rotor comprises a permanent magnet.